



Executive summary

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Report on multiple criteria assessment of the studied waste collection systems and applicability of different methods for decision-support

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Credits

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Introduction

This report presents the main findings from the four COLLECTORS workshops and the multicriteria decision-making (MCDM) exercises; analyses challenges related to studied decision-making situations and provides recommendations about the use of MCDM methods in the context of waste management and collection. In addition to data collection, a central aim of the MCDM workshops was to provide the participants with possibilities for discussion and knowledge exchange, and a chance to learn about the MCDM methods.

Aim of multicriteria decision-making

Decisions related to waste collection are examples of multicriteria decision-making situations, in which the decision-makers are confronted with concerns related to regulatory demands, costs, environmental issues, user preferences, technical issues and feasibility. With the help of MCDM, different dimensions, such as environmental and economic impacts that are important for the decision-making context, may be considered and evaluated one at a time. With the help of group decision-making methods, opinions from several decision-makers (possibly having different values and preferences) can be collected and included in the decision. The purpose of an MCDM method is to establish a ranking of the alternative options, based on available information on the alternatives themselves and the decision-makers' preferences.

Background for the study

In the scientific literature, use of MCDM methods in the context of waste management is getting more and more popular. MCDM methods are typically applied in studies that aim at selection of optimal waste management strategy or identification of optimal location for a recycling facility or landfill. Majority of the MCDM studies published in scientific journals have focused on management of municipal solid waste (MSW). Some studies related to handling of waste electronic and electrical equipment (WEEE) and construction and demolition waste (CDW) can be found, but studies focusing on packaging and paper waste (PPW) are rare.

This study complements existing literature by presenting the results of two MCDM workshops that focused on collection of PPW and WEEE, and applied economic, environmental and social criteria for decision-making. Besides, the study discusses common challenges related to decision-making process in the context of waste management, and considers how MCDM methods could be used to support the process in different phases.

Materials and methods applied in the study

The findings of this report are based on four expert workshops that were organised during the COLLECTORS project. Participants of the workshops were experienced waste professionals working

for municipalities, municipal waste management companies, regional associations and representatives of the producer responsibility organisations from different European countries.

The MCDM methods that were applied for group decision-making were Multi-Attribute Value Theory (MAVT), Preference Ranking Organization and Method for Enrichment Evaluation (PROMETHEE) and Analytical Hierarchy Process (AHP), all being well-established decision-making methods. The decision-makers' preferences on the importance of different criteria was measured using SWING weighing.

Main conclusions

Challenges related to decision-making

The findings from the workshops indicated, that it is important to consider the decision-making process related to waste collection as a series of connected events (that may take place in parallel), rather as one occasion. In addition, decision-making is a social process, in which challenges related to cooperation and stakeholder engagement can be significant.

In line with the scientific literature related to use of MCDM, the experiences from the workshops confirm that MCDM is useful for formulating priorities between the goals and actions in waste management. Besides, the findings from the study highlight, how MCDM could be useful for the problem definition and idea generation phases, and for collecting input and reaching consensus between different actors. The findings from this study indicate that both are important and challenging phases when considering the decision-making process as a whole.

In the context of waste collection, decision-making seems to be often affected by lack of precise or comparable data. This was one of the main challenges identified during the study. Filling in existing data gaps requires systematic efforts, implementing monitoring activities and cooperation (data exchange) between actors in the recycling value chain. This is necessary for improving all stages of the decision-making process in future.

Recommendations related to use of MCDM methods

All approaches to MCDM incorporate a definition of an ultimate goal, alternatives to choose from and a set of evaluation criteria. These can be considered as pre-requisites for informed decision-making, and their assessment requires the most of the effort in MCDM. Exercises need to be carefully prepared, and workshops facilitated. In addition, some knowledge about the MCDM methods is necessary, and dedicated softwares are most likely needed, especially if large amounts of data are used, or in case many participants are present. However, structuring of the decision-problem and definition of the criteria can already be useful, and can be conducted without specific tools and with very basic knowledge about the methods.

Several MCDM methods were applied during the project. Use of AHP can be recommended for the problem definition and idea generation phases, when quantitative data about the performances of different options is still lacking. Use of AHP is most practical in situations when the amount of discussed options and applied criteria is limited. When choosing a waste collection strategy, or prioritising options in a situation when potential performance of the alternative options is known, several MCDM methods can be applied. In this project, applied methods included MAVT and PROMETHEE.

The experiences from the workshops revealed, how MCDM can be used for creating discussion and collecting opinions from participating decision-makers. In all workshops, a lot of time was dedicated for discussion, and for listening the arguments of the participants. This way, the participants had a chance to learn from the responses of others, and exchange ideas related to good practices. All the workshops were characterised by vivid discussion and knowledge sharing.

The benefits of structured methods relate to the need to for systematic consideration of the desired goals from the point of view of multiple criteria. This usually reveals knowledge gaps, but also interlinkages (possibly related problems) that need to be considered. However, structured analysis may also feel burdensome for the participants, as all steps of the assessment have to be systematically conducted. Participating experts have to be committed and pay attention to all the details that are necessary for successfully conducting the exercise.

Based on the findings of this study, following recommendations related to use of MCDM methods can be made:

- Multiple criteria (reflecting diversity of economic, environmental and social aspects) should be included in expert-driven decision-making in waste management.
- Problem definition and data gathering stages require the most time and effort, and are prerequisites for informed decision-making. These phases also create the majority of benefit related to use of structured decision-making methods.
- Carrying out MCDM workshops at early stages in strategy selection reveals knowledge gaps and indicates priorities for further assessments.

Limitations of the study

Results from group decision-making are always related to the context in which they were produced. Thus, the results from one exercise cannot be directly generalised as applicable elsewhere. However, the results may reveal aspects that are interesting and important, and that may apply in other contexts as well. The analysis of the applied decision-criteria and their usefulness for decision-making continues in COLLECTORS report D4.4 Generalised criteria to support decision-making.

In group decision-making, the composition of the group is essential for successfully conducting the exercise. In this study, all exercises required a lot expertise and personal judgment from the participants. It is considered, that the long professional experience of the participants increases the value of the results. However, since all participants were experts working with municipal waste

management or within producer responsibility organisations, the results reflect the point of view of the cities, regions and the producers. Thus, important aspects from the point of view of other stakeholders (such as consumers) might be lacking from this study.

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